

the chapter which treats of river deltas and the dispersion of sediment by currents, and in the description of reefs of coral now growing over areas many hundred miles in length, I shall have opportunities of convincing the reader of the danger of hasty generalisations on this head. I may also mention in this place that the vast distance to which the White Chalk can be traced east and west over Europe as well as north and south, from Denmark to the Crimea; seemed to some geologists a phenomenon to which the working of the causes now in action present no parallel. But the soundings made in the Atlantic for the submarine telegraph have taught us that white mud formed of organic bodies similar to those of the ancient Chalk, is in progress over spaces still more vast" (p. 109).

The teaching of Sir Charles Lyell is that all the rocks have been formed from pre-existing rocks as far back as we can trace them, in the same manner as they are being formed now, and that those which we see preserved are such as from their nature or surrounding circumstances were fittest to survive the various denuding forces to which they would from age to age be subjected.

Surely this is the true theory of evolution applied to geology. It does not, on the one hand, hold that the world has been going on always just as it is—that after a long period, during which all the varied forces of nature have been in full activity, the earth could be found in the same state as it was at the commencement. Nor, on the other hand, does it teach that the earth has been developed according to any original tendency or impulse, but that by the *uniform* action of forces such as we see now in operation it has been *evolved* out of previous states.

Nor is the objection valid that there is any "weakness or logical defect" in the teaching which would limit the inquiry to the period of which we have a record in the crust of the earth. If the true methods are employed, it is no objection to the methods themselves that their application is not more extended.

What were the possible or necessary first combinations out of a chaotic mass is a fair subject for investigation; but an author is no more to be censured for excluding it from a work treating of the visible crust of the earth, than a philosophic writer on the history of England is to be blamed for not including in his inquiry the conditions of that part of the earth now represented by our island previous to its last emergence from below the sea.

T. MCK. HUGHES

(To be continued.)

NOTES

PROF. HUXLEY's friends will be rejoiced to hear that he has returned to this country, with his health and strength fully recruited by his absence from work; and that he has already resumed his lectures at the Government School of Mines.

THE *Examiner* prints the following extract of a letter from M. Elisée Reclus, dated Zurich, March 18:—"I am able at last to tell you that I am free. After having been kept for a long time in prisons, and sent from one prison to another, I left Paris for Pontarlier, escorted by two police agents, who left me on the free soil of Switzerland. While breathing and enjoying the pure air of liberty, I do not forget those to whom I am indebted for my freedom. Having been claimed by so many Englishmen as a student of science, I shall work on more than ever to show them my gratitude by my works and deeds."

THE Astronomer Royal will hold his first reception, as President of the Royal Society, on Saturday evening, the 27th inst.

It will be seen from our report of the Proceedings of the Chemical Society that Prof. Cannizzaro has been selected by the Council to deliver the Faraday lecture on Thursday, May 30.

THE Council of the Society of Arts has invited members of the Society to forward to the secretary, on or before April 29, the names of such men of high distinction as they may think worthy of receiving the Albert Medal, instituted to reward "distinguished merit in promoting arts, manufactures, or commerce." The recipients of the medal since its foundation, in 1864, have been Sir Rowland Hill, K.C.B., the Emperor of the French, Prof. Faraday, Sir W. Fothergill Cooke and Sir C. Wheatstone, Sir Joseph Whitworth, Baron von Liebig, M. de Lesseps, and Mr. Henry Cole, C.B.

MR. H. E. ARMSTRONG has been appointed Lecturer on Botany and Vegetable Physiology at the University of Durham College of Medicine, Newcastle-upon-Tyne.

A NUMBER of gentlemen connected with the Iron and Steel Institute, from the different parts of the Kingdom, and also from the Continent, assembled last week to the number of 200 or 300 at the Teeside Works, Middlesborough, belonging to Messrs. Hopkins, Gilkes, and Co., to witness the first public trial of the rotary puddling machine of Mr. Danks, to which we have recently referred. The machine has been in work for two or three weeks, and realises all that has been claimed for it by its inventor, and all that has been stated of its practicability by the Iron and Steel Institute Commission, which was sent to the United States to investigate the working of the machine. On Friday the gentlemen present saw the machine charged two or three times with molten metal, and generally the heat took about an hour, with all the different preparations, from the time of drawing the heat till the introduction of another. The quantity puddled at one time was between 5 and 6 cwt. generally, but as high as 1,000 lbs. have been put into the furnace at one charge. The iron, after leaving the furnace, was hammered, and then re-heated and rolled into bars, the quality of which was stated to be very superior. They were all produced from No. 4, Cleveland pig iron. The "fettling" consisted of American ore and pottery mine. The important adjunct of a "seizer," which is part of Mr. Danks's invention, is not yet built, so that the operation was not complete. An unexpected occurrence happened later in the day, an opinion having been received from counsel that Mr. Danks's patent was not valid. A meeting was held between Mr. Danks and most of the gentlemen who had entered into the provisional arrangement to pay him by the 10th of April 50,000*l.* for the right of 200 of his furnaces, to which we have already alluded, and he was informed that the arrangement would not be ratified. The question remains open, and is entrusted to a committee of the gentlemen interested, who will report to a future meeting.

THE establishment is announced of a Meteorological Observatory at the top of the mountain of Puy-de-Dôme. The original cost of 1,000*fr.* will be borne one-half by the State, one-fourth by the town of Clermont, and one-fourth by the Council-General of Puy-de-Dôme. The annual cost of its maintenance will devolve on the town of Clermont.

CAPTAIN H.R.H. THE DUKE OF EDINBURGH, K.G., has signified his intention of becoming a vice-president of the Institution of Naval Architects.

UNDER the new management and direction of the Royal Polytechnic Institution, it has been determined to re-establish the scientific department of the Institution, and Mr. Edward V. Gardner has been appointed Professor of Chemistry. We understand that the Institution is about to arrange a well-organised laboratory, proper chemical accessories for lectures, classes, analyses, &c., of which due notice will be given in the papers when the arrangements are completed.

THE Council of the Literary and Philosophical Society of Leicester have received from Mr. John Bennett the sum of 20*g*s.,

for the purpose of offering prizes to students of Natural Science, and as an inducement to the useful occupation of that leisure which is afforded by shortened hours of labour. Mr. Bennett's prizes will be awarded immediately after Easter Week, 1873, according to the following plan:—1. Geology—Three prizes will be given of the value of 3gs., 2gs., and 1g. for the best collections of the Rocks of Leicestershire, named, and with the localities given from which they were obtained. 2. Botany—Three prizes will be given of the value of 3gs., 2gs., and 1g. for the best collections of dried specimens of the Flowering Plants of Leicestershire, properly mounted, with the name, locality, and date of gathering attached to each; and classified according to the natural system. The scientific name must be given to each plant, and the popular name or names when it has any. 3. Freshwater life, animal and vegetable—Three prizes will be given of the value of 3gs., 2gs., and 1g. for the best aquaria, containing not more than two gallons of water, stocked with animal and vegetable life from the ponds, brooks, and rivers of Leicestershire, accompanied by a list of the specimens, with their scientific and popular names, and the locality and date of collection.

MR. JAMES CHAMBERLIN, of Norwich, announces that, with the idea of improving the breeding of pheasants, he will award ten prizes varying in value from 1*l.* to 5*l.* for the best brace raised during the present year, on conditions which may be learned on application.

It is intended to form early in May a class for the study of Botany in the field belonging to the series of Church of the Saviour Science Classes. The object of the class is to enable Science students and others to obtain a practical knowledge of Systematic Botany, and to familiarise themselves with the form, structure, and habits of the principal flowering plants of the district. As the class will be limited in number, the names of intending students should be sent at once to the teacher—Mr. Joseph W. Oliver, 35, Cannon Street; to Mr. W. T. Bulpitt, Albert Road, Aston; or to the secretary, Mr. W. H. Hemming; when arrangements will be made for a preliminary meeting.

DR. FRASER will deliver two lectures on April 19 and 26 at 8 P.M., before the Fellows of the College of Physicians, on "The connection between the chemical properties and the physiological action of active substances;" and on "The antagonism between the actions of active substances."

THE third course of Cantor Lectures of the Society of Arts for the season will be by Prof. Barff, on "Silicates, Silicides, Glass, and Glass-painting," and will be delivered on Monday evenings, from April 8 to May 13.

WE understand that at the request of the executors of the late Sir James Y. Simpson, his friend, Prof. Duns, has undertaken to write his biography.

THE *Journal of Botany* mentions the appearance of a new botanical journal, under the title of *Journal de Botanique, pure et appliquée*, edited by M. G. Huberson, to appear fortnightly. It will contain, besides original communications, translations, extracts, and abstracts of botanical papers presented to the Académie des Sciences.

THE Literary and Philosophical Society of Manchester has just published the tenth volume of its "Proceedings," containing an unusual number of papers of great value and interest.

WE have received a copy of the lectures delivered at the Lecture-room of the Industrial and Technological Museum, Melbourne, for the autumn session of 1871. They deal with such subjects as Geology and Palæontology in their application to useful purposes, Respiration, Radiant Energy in relation to the spectrum, Forest culture in its relation to industrial pursuits, and

various branches of manufacture. How long will it be before our Home Government undertakes such work?

A VERY useful addition has been made to the series of publications issued by order of the Secretary of State for India in Council, in the form of "A Continuation of Maps of the British Provinces in India and other Parts of Asia, 1870."

DR. STOLICSZKA, the palæontologist of the Geological Survey of India, has, during his stay on deputation in Kutch, made, according to the *Times of India*, an extremely valuable collection of zoological and fossil specimens. The doctor, it is said, anticipates that fully one-half of the latter are new to science.

THE sale of Wombwell's Menagerie, to which we referred a few weeks since, took place at Edinburgh on Tuesday last. Among the prices realised were the following:—Tasmanian devil, 3*l.* 5*s.*; Diana monkey, 7*l.*; mandrill, 30*l.*; ditto, 5*l.*; Anubis baboon, 10*l.* 10*s.*; ditto, 8*l.* 10*s.*; condor, 15*l.*; emeu, 7*l.*; pelicans (two), 6*l.* 15*s.* each; nyghau, 26*l.*; ditto, 10*l.* 10*s.*; lama, 15*l.*; boomer kangaroo, 12*l.*; ocelot, 6*l.* 10*s.*; African porcupines (three), 5*l.* 10*s.* each; wombat, 7*l.*; Polar bear, 40*l.*; brown bear, 7*l.*; performing leopard, 20*l.*; performing leopardess, 20*l.*; ditto, ditto, 20*l.*; performing hyæna, 3*l.* 5*s.*; lion, "Wallace," 7½ years old, 85*l.*; royal Bengal tigress, in cub, 3 years old, 155*l.*; lion, "Duke of Edinburgh," 3 years old, 140*l.*; lionesses, "Princess" and "Alexandra," about 3½ years old, 80*l.* each; lioness, "Victoria," 4 years old, in cub, 105*l.*; black-maned lion, "Hannibal," 6½ years old, 270*l.*; lion, "Nero," 7½ years old, 140*l.*; lion, "Prince Arthur," 18 months old, son of "Hannibal," 90*l.*; lion, "Prince Alfred," 18 months old, son of "Hannibal," 90*l.*; spotted hyæna, 15*l.*; Burchell zebra, 50*l.*; gnu, 85*l.*; male tusked elephant, 7 feet 6 inches high, nearly 8 years old, 680*l.*, bought for the Zoological Gardens, Manchester; female elephant, 5 feet 6 inches high, 145*l.*; two boa constrictors, 6*l.* each; Malabar squirrel, 5*l.*; male Bactrian camel, 7 feet high, 12 years old, 19*l.*; female ditto, in calf, 6½ feet high, 10 years old, 30*l.*; ditto, ditto, in calf, 6½ feet high, 5 years old, 23*l.*; male ditto, 5 feet high, 11½ years old, 14*l.*; female ditto, in calf, 5 feet high, 1½ years old, 14*l.*; male dromedary, 7½ feet high, 5 years old, 30*l.*; female ditto, 6½ feet high, 14 years old, 21*l.*; male camel calf, born February 6, 1872, 9*l.* 10*s.* The sale produced nearly 3,000*l.*

THE severe frost of March 21 has done an incalculable amount of damage to the fruit crop. Apples, pears, and cherries appear to have suffered most severely. It is a remarkable circumstance that although the majority of the flowers have been killed in the bud, the central part being turned perfectly black, yet the flowers expand and present externally a perfectly uninjured appearance. The *Garden* estimates the damage done to the potato crop in Jersey by the spring frosts at many thousands of pounds.

ALTHOUGH the Brighton Aquarium has been formally opened to the public, it is still in a very unfinished condition, owing to a disagreement between the proprietors and the contractor, and the severe illness of the engineer. At the time of its inauguration by Prince Arthur, on Easter Monday, but one tank was supplied with fish. When completed, the collection will by no means be confined to marine animals, a portion of the building being devoted to fresh-water tanks.

THE Senate of the University of Bombay has recently been engaged in investigating a scandal in connection with the Matriculation Examination, the passages set in Latin being taken entirely from books which one of the examiners had during the previous term made the special subject in his own class.

THE *Engineer* states that the oxyhydric light has not proved a success in Paris, and that it has been discontinued in the public lamps on the Boulevard des Italiens.

MESSRS. WATERLOW AND SONS, of 66, London Wall, announce that the invention of an entirely new method of producing a number of copies of the same manuscript without the use of ink, by a very simple process which they term printing by electricity, and to which we have already referred, may now be seen in operation on their premises.

WE have received a circular from the Secretary of the Philadelphia Philosophical Association, containing a statement of its leading principles, and an outline of the method pursued in carrying them out. These principles are stated to be:—1, That force is persistent; 2, That all knowledge is relative; 3, That philosophy is the synthesis of the doctrines and methods of science; 4, The critical attitude of philosophy is not destructive, but constructive; not sceptical, but dogmatic; not negative, but positive. The Association appears to have been established in November 1871, and proposes to select a number of suitable papers, or parts of papers, for publication in a Quarterly Journal.

A CORRESPONDENT at Brighton describes a solar phenomenon visible on the afternoon of April 8, at 5.35 P.M. The sun being just within the upper part of a mass of light clouds, through which it shone with a white glare, there appeared a distinct belt of colours, in order and apparent width exactly like those of an ordinary rainbow, but apparently flattened above. Half a minute afterwards a second belt appeared, equally bright, and with no interval between the two. At the same time a fainter belt appeared to the right, but not forming a part of the same circle as the others. The three were visible together, but did not last above a minute. After the unusual appearance was first noticed, the sky above was tolerably clear, with a few light upper clouds. After the prismatic lines had faded, there was that diffused white glare round the sun which is commonly said to betoken windy weather.

THERE is now every prospect that the getting of coal by machinery will be more generally adopted than hitherto. At present it has only been adopted at a few places, but a new machine, patented by Messrs. Gillott and Copley, has just been tested at the Wharmcliffe Silkstone Colliery, near Barnsley, in the presence of a number of mining engineers from various parts of the kingdom, and with most satisfactory results. In 136 minutes a bank of coal, 58 yards long and four feet eight inches thick, was cut to a depth of three feet one inch. The quantity of coal so cut would be about 80 tons in the time stated. In connection with coal machinery a hydraulic coal breaker, patented by Mr. Clubb, of London, has just been very successfully tested at the Oaks Colliery. Barnsley.

AN Indian paper prints the following interesting account of a fight between a hyæna and a man:—"About five days ago a party of six natives coming towards Deyra through the Mohun Pass, were attacked by a hyæna; it made straight at one of them, and flew at his throat. The poor devil stretched out his hands to keep off his assailant, on which the hyæna bit them severely; his companions, instead of coming to his aid, took refuge in some adjoining trees; the man, finding himself thus deserted and his hands in a mutilated state, pluckily turned on his enemy, and seized his nose with his teeth, roaring out in the best way he could for assistance. By this means he secured the animal, and his companions, taking courage, came down from their secure position, and belaboured the beast to death with sticks. I saw the unfortunate man at the dispensary, where he had gone to have his wounds dressed, and was shown the head of his enemy having his teeth marks on the nose. I believe this is almost an unprecedented instance in the annals of natural history, as a hyæna is well known as a most cowardly brute, never venturing to attack man, but preying chiefly on dogs, carrion, and young children."

ANNUAL ADDRESS TO THE GEOLOGICAL SOCIETY OF LONDON, FEB. 16, 1872

By J. PRESTWICH, F.R.S., PRESIDENT

(Continued from page 433.)

Our Coal-measures and our Coal-supply

WHILE the presence of water has determined the early settlement of population, the existence of coal has given rise to exceptional local growths of that population, quite irrespective of the original cause of settlement. The existence of coal has created new wants, developed vast energies, enormous resources, and has established great industries dependent upon it for their maintenance and prosperity. Natural causes, unceasing and ever renewing in their action, maintain our supplies of water in a condition of constant and unfailing operation. They are physical and geological agents, equally in force in the past as in the future of the earth's history. Not so with coal, which is a store of the past, and of which we can look for no renewal. Our Coal Measures, great as they are, have defined limits, whereas our wants seem to have no bounds. With the increasing magnitude of the latter our fears of the extent of the former have increased, and have given rise to much speculation and much discussion. At first the estimates of the duration of our coal-fields were little more than guesses; but the subject has of late years been treated in a systematic manner, and in all its various bearings, in the able works of Hull, Jevons, and Warington Smyth. To obtain more precise data on these important questions, the Royal Commission of 1866 was appointed, with your President-elect, the Duke of Argyll, at its head. On the practical and economical questions different members of the Commission and separate committees have made valuable reports. I wish on this occasion merely to direct your attention to some of the more special geological bearings of the questions discussed in one of the committees, of which the lamented Sir Roderick Murchison was chairman, the object being "to inquire into the probability of finding coal under the Permian, New Red Sandstone, and other superincumbent strata."

On the evidence laid before this committee regarding England north of the Bristol coal-field, Prof. Ramsay was deputed to report, while the south of England was relegated to myself. The one district embraces all the unproved older secondary tracts between the different well-known coal-fields of the central and northern portions of England. The other district takes in that occupied by the later Secondary and the Tertiary strata, already the subject of a valuable paper in our Journal for 1856, by Mr. Godwin-Austen. The excellent mapping of our coal-districts by the Geological Survey, and their accurate sections through the several coal-fields, furnished Prof. Ramsay with data which have enabled him to prolong these sections across the intervening tracts with a degree of certainty which gives them very great value. He has presented us with 32 such sections, which, when published, will, with the text already before the public, show how great has been the task, and how successfully it has been accomplished.

The area of the exposed coal-measures of England may be estimated at about 2,840 square miles. To these Mr. Hull had added 932 square miles of coal-measures overspread by newer formations. The investigations of Prof. Ramsay lead him now to conclude that this latter total of unproved coal-measures may be increased to 2,988, to which may be added 153 miles of the Bristol coal-field, making a total of 3,141 square miles of Coal-measures under the Permian, New Red, and Triassic strata of central and northern England, or of 301 square miles more than the area of all our exposed coal-fields. This branch of the inquiry embraces curious questions of variations in the mass of the coal-measures, in the thickness of the strata, and in the number and persistence of the coal-seams. The extent and magnitude of the faults bounding so many of our coal-fields, is also a point of great difficulty, especially when it is complicated by denudations of pre-Permian and of pre-Triassic age; and in this intricate inquiry it must be borne in mind that it is only a question of superposition and faulting, but one also of removal and replacement, involving a number of important geological problems. Especially is it necessary to distinguish steep old-surface and submarine valley denudations from faults.

The other inquiry relating to the possible range of the coal-measures under the Jurassic, Cretaceous, and Tertiary strata of the south-east of England, involves questions of a much more hypothetical character, and can, in the absence of positive in-